for U. S. filing

CLAIMS

I claim:

1. Actuator including a first tubular body (20), a nut (70) positioned inside the tubular body (20) and having at least a generally helical ball-race (41-51 ; 52-62) including a helical portion extending about the nut (70) according to an angle of less than 360 degrees and a widened portion (81) connecting the ends of the helical portion, said widened zone (81) forming a re-circulation zone for the balls (22) arranged between the ball-race (41-51 ; 52-62) and the inner surface (21) of this tubular body (20), this actuator also including driving means (2) for rotating the nut (70), in order to ensure the displacement in translation of the tubular body (20) with respect to the latter, characterized in that the inner face (21) of the first tubular body (20) includes helical ball-races for guiding the balls (22).

2. Actuator according to claim 1, characterized in that the inner surface (21) of the first tubular body (20) has a helical pitch substantially equal to the helical pitch of a ball-race (41-51, 52-62) of the nut (70).

3. Actuator according to any of the preceding claims, characterized in that the nut (70) includes several ball-races (41-51 ; 52-62), each of the ball-races having a re-circulation zone for the balls and in that the ball-races are so arranged that the re-circulation zones for the balls are not aligned in a direction of translation of the actuator.

4. Actuator according to claim 3, characterized in that the ball-races (41-52 ; 5262) are so arranged that the re-circulation zones are regularly angularly distributed about the direction of translation of the actuator.

5. Actuator according to any of claims 1 to 4, characterized in that the nut (70) includes several aligned elements (40, 50, 60), of a cylindrical general shape, each having at least one bevel (41, 51 ; 52, 62) forming a helical cam surface, the bevels (41, 51 ; 52, 62) forming, two by two, helical ball-races in which balls (22) are positioned.

6. Actuator according to claim 5, characterized in that each helical cam surface (41, 51, 52, 62) forms a setback (45, 55) and in that two elements (40, 50, 60) are so positioned with respect to each other that their setbacks (45, 55) are facing each other, said setbacks forming the re-circulation zone (81) for the balls (22).

7. Actuator according to claim 5, characterized in that the prestressing exerted on the balls (22) is generated by tightening the elements (40, 50, 60) with respect to each other.

8. Actuator according to claim 7, characterized in that it includes a nut for adjusting (4) the elements (40, 50, 60), in order to control the prestressing exerted on the balls (22).

9. Actuator according to claim 8, characterized in that it includes springy means (5) interposed between the adjusting nut (4) and the elements (40, 50, 60) of the nut (70), through which the adjusting nut (4) exerts a prestressing on the elements (40, 50, 60).

10. Actuator according to one of claims 3 to 9, characterized in that each element (40, 50, 60) is formed from a cylindrical part with a straight cross-section (400) one circular edge of which is beveled, in order to form said helical cam surface inclined with respect to the axis (401) of the cylindrical part (400), the ends of the helical surface being connected by a setback surface (45) of a conical general shape.

11. Actuator according to claim 10, characterized in that the ball-race (41-51; 52-62) includes a widened re-circulation zone (81) for the balls (22) defined by the setback surfaces of two elements (40, 50), the setback surfaces being positioned in front of each other, in an opposite way.

12. Actuator according to any of the preceding claims, characterized in that the driving means (2) for driving the nut (79) include a motor mounted fixed inside a second tubular body (10) capable of being driven in translation with respect to the first tubular body (20).

13. Actuator according to one of claims 1 to 12, characterized in that the ball-races at the level of the inner surface (21) of the tubular body (20) are formed by plastic distortion of this inner surface (21) by the balls (22), followed by a treatment for hardening this inner surface (21) of the tubular body (20).

14. Actuator according to any of claims 1 to 12, characterized in that the ball-races at the level of the inner surface (21) of the first tubular body (20) are formed by at least one wire (91) positioned in the shape of a spiral inside the first tubular body (20).

15. Actuator according to claim 14, characterized in that it includes a first wire (91) positioned in the shape of a spiral inside the first tubular body (20), on which the balls (22) rest and a second intercalated wire (92) having a diameter smaller than that of the first wire (91) and extending between the windings of the first wire (91), this second wire (92) maintaining the separation between the windings of the first wire (91).

16. Actuator according to one of claims 1 to 12, characterized in that it includes an inner tube (93) arranged in the tubular body (20) and welded to the latter, the inner tube (93) having ball-races carried out by burnishing.

17. Actuator according to one of the preceding claims, characterized in that it has a third tubular body (300), the first tubular body (20) being connected to a second nut (370), the rotation of the second nut (370) causing the displacement in translation of the third body with respect to the first tubular body (20), the actuator thus constituting an actuator of the telescopic type.

18. Actuator according to one of the preceding claims, characterized in that the first tubular body (20) is made out of aluminum, KEVLAR©, carbon fibers or molded plastic.